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EVALUATION OF THE NECESSITY FOR CONDUCTING DURABILITY TESTS AS PART OF THE OU 2 TREATABILITY STUDY

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ENCLOSURE

EVALUATION OF THE NECESSITY FOR CONDUCTING DURABILITY TESTS AS PART OF THE OU 2 TREATABILITY STUDY

INTRODUCTION

The OU 2 Treatability Study is being conducted to provide additional information for the selection of final remedial alternatives during the Feasibility Study (FS). The remedial alternatives, which were selected in the Initial Screening of Alternatives (ISA) for further detailed analysis are containment (capping); containment and in-situ stabilization (lime sludge ponds); removal of waste and on-site or off-site disposal; and removal and treatment of waste with on-site or off-site disposal. Before the wastes are dispositioned under a remedial alternative for on-site or off-site disposal they will be packaged as stated in the ISA.

The Work Plan defining the treatability study requirements for UO 2 was submitted to the U. S. and Ohio EPAs for review in October of 1991. The Ohio EPA reviewed the Operable Unit 2 Treatability Study Work Plan and requested the addition of Durability Testing to the Advanced Phase of the Treatability Study.

OU 2 TREATABILITY STUDY GOALS

The primary goal of the OU 2 treatability study is to support remedy selection during the FS. It supports the FS by providing data concerning the waste treatment under consideration. This information is used to select the most effective treatment technologies for further consideration in conjunction with other aspects of the proposed alternative designs.

Preliminary remediation goals have been determined for chemicals and radionuclides (listed in Section 3, Tables 3-1 thru 3-3 of the Treatability Study Work Plan for OU2). The treatability study is designed to provide data to determine whether attainment of these goals is feasible using the technology of cement stabilization and tests have been selected accordingly. The intent of these treatment methods is to chemically fix the contaminants in an altered waste matrix and thereby lowering their leachability.

DURABILITY TESTING AND ITS APPLICABILITY TO OU 2 WASTES

An evaluation consisting of a literature search of durability testing and its applicability relative to the OU 2 treatability study goals and the remedial alternatives was conducted. The pertinent results of this evaluation are as follows:

1. The U.S. NRC Technical Position on Waste Form (Revision

1), January 1991[1], page A-3 states that the compressive strength of 500 psi should be used for the waste form to provide assurance that the waste form will maintain structural integrity and thus possess the long term structural capability required by 10 CFR 61. This criterion was incorporated into the OU 2 Treatability Study.

2. The U.S. NRC Technical Position referenced above also elaborates on 10 CFR 61.56(b), which states that a waste form must keep its structural integrity under *expected* disposal conditions to meet stability requirements. Structural stability is necessary to inhibit the following:

   a. Slumping, collapse, or other failure of the disposal unit (*if an engineered structure is not used*) resulting from degraded wastes which could lead to water infiltration, radionuclide migration, and costly remedial care programs and;

   b. Leaching caused by premature disintegration of the waste form, which could cause radionuclide migration. The leachability of OU 2 treated wastes is being tested through the TCLP.

3. 10 CFR Part 61 is the regulation for near-surface disposal of radioactive wastes and waste forms. The wastes are divided into three general classes: A, B, and C. OU 2 wastes are similar to those classified as general class A wastes, which is the lowest level of radioactive waste. All three classes are required to meet certain minimum requirements for disposal (10 CFR 61.56(a)).

4. Class B and C wastes have an additional minimum requirement, namely *structural stability*, which is not a requirement for class A radioactive wastes. However, taking a conservative approach structural stability is being considered as indicated in item 1.

5. If durability tests are conducted and their results are considered unacceptable then an adjustment in design can be made, as stated by the U.S. EPA document on stabilization and solidification of CERClA and RCRA wastes:

   "Poor durability results often can be addressed by

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[1]U.S. Nuclear Regulatory Commission Technical Position on Waste Form (Revision 1), January 1991

a change in design and should not be used as automatic grounds for exclusion. For example, materials that fail freeze-thaw durability testing can be placed below the frost line to mitigate their poor durability property".[2]

6. If capping and in-situ stabilization (lime sludge ponds) is selected as a remedial alternative, the stabilized waste will be below the frost line. Therefore, the solidified waste will not be subjected to freeze-thaw cycles. The cap will also eliminate rainwater infiltration thus greatly reducing the possibility of wet-dry cycles.

7. If removal and waste treatment, and on-site or off-site storage are selected as remedial alternatives, some solidification of the treated wastes may be considered. However, the ISA states that the wastes will be packaged before storage. Consequently the durability of the packaging is of critical concern.

8. Interpretation and applicability of durability test results are still in the developmental stage. ASTM D4842 and ASTM D4843 currently have no established pass standards for stabilized material (see footnote #2), "however, Vick et al. (1987) suggest that 15 percent weight loss is an acceptable amount". Also, "very few stabilized materials can withstand the full 12 cycles" of the tests. Consequently, durability test results would be subject to varied interpretations and are not expected to assist in conclusively determining the feasibility of the remedial alternatives.

9. Durability tests on waste forms are only a measure of mass loss after every cycle with the test terminating when mass loss is 30%.

10. Mass loss measurements through the durability tests will not determine the leaching potential of radionuclides from altered solidified waste forms, which is one of the purposes of structural integrity as noted in item 2.

11. Durability test cycles cannot be directly correlated to actual durations in time (i.e. the number of years a solidified waste form will last under actual relevant physical conditions versus the number of test cycles

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[2]STABILIZATION/SOLIDIFICATION OF CERCLA AND RCRA WASTES; Physical Tests, Chemical Testing Procedures, Technology Screening, and Field Activities, EPA/625/6-89/022, page 4-17, section 4.6.3

completed).

SUMMARY AND CONCLUSIONS

The 500 psi UCS criterion recommended by the NRC (item 1) is expected to be adequate to ensure structural integrity for long term structural capability of the in-situ stabilized Lime Sludge Ponds. In addition, the stabilized waste may be covered by a 5 foot RCRA cap, which fulfills the requirements of the defined ARARs and will minimize water infiltration and place the waste below the frost line, thereby eliminating freeze-thaw and wet-dry cycles. Also, as indicated in 10 CFR 61.56(b) (Item 2 above) the main purpose of maintaining structural stability is to avoid waste form degradation and premature disintegration possibly resulting in disposal unit failure and subsequent water infiltration, contaminant migration, and leaching. However, if waste form disintegration or water infiltration does occur, any substantial contaminant migration or leaching is precluded. This is due to the fact that the stabilized waste forms can not leach waste material above the established regulatory limits for the TCLP which is being conducted for the OU 2 Treatability Study.

For the other sub-units in OU-2, containment (capping) or waste removal, treatment, packaging, and on site or off site storage are the considered alternatives according to the approved ISA report (removal is also possible for the lime ponds). If removal is selected as an option for any of the sub-units, the structural integrity and long term capability of the packaging container is also a critical item of concern which is not within the purview of the OU-2 Treatability Study. However, packaging and placement in a container will only add to the overall structural stability.

It should be noted that pursuant to 10 CFR 61.55 OU 2 wastes are similar to those clasified as general Class A wastes category which do not require structural integrity criteria. However, a conservative and prudent approach is being taken by invoking the 500 psi UCS and TLCP criteria.

Durability tests ASTM D4842 and D4843 measure mass loss after each test cycle under the prescribed test conditions. The tests are apparently intended to subject solidified waste forms to physical conditions expected during storage. Waste forms may encounter wet-dry or freeze-thaw conditions during their interment or storage making these tests quite relevant. However, due to the projected long term conditions that OU 2 remediated wastes will incur, the conditions set forth by the durability tests are not specifically pertinent to OU 2 solidified waste forms. These tests would not provide useful information relevant to the long-term stability of OU-2 waste forms and their potential to leach contaminants. Furthermore, the current ASTM durability tests for waste forms are subject to varied interpretations and their application to OU-2

waste forms is unclear.

The proposal not to conduct durability testing pertains only to the OU 2 Treatability Study. The Department of Energy is confident that the treatability study as presently designed will provide the critical performance data needed to evaluate the applicable treatment alternative and select an alternative for remedial action based on the nine RI/FS evaluation criteria. Specifically, the combination of information derived form the Unconfined Compressive Strength, Shear Strength, and Permeability Testing in addition to the TCLP results pertaining to leachability will allow for an adequate analysis of the alternatives.